VALUE CREATION AND CAPTURE WITH OPEN SOURCE SOFTWARE: A THEORETICAL MODEL FOR UNDERSTANDING THE ROLE OF VALUE NETWORKS

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Abstract

This paper aims at examining how firms create and capture value with open source software (OSS). OSS is seen as an excellent exemplar of both peer production and open innovation. Nevertheless, the use of OSS as a form of open innovation is such a recent phenomenon that many unanswered questions still persist. The very concept of OSS represents phenomena that require firms to rethink their strategy as the shift in focus from ownership to one of openness requires a reconsideration of the processes that generate value creation and capture. In responding to this research gap, this paper begins a theory building process for examining OSS value creation and capture. In particular, various theoretical frameworks employed for value creation and capture are explored. The findings of this analysis reveal the importance of a value network for value creation and capture with OSS and the paper concludes by using theoretical propositions to illustrate relationships.

Keywords: Open Source Software, Open Innovation, Value Creation, Value Capture, Value Network, Business Model

1 INTRODUCTION

Open source software (OSS) is seen as one of the most well-established examples of peer production (Feller et al., 2008; Benkler, 2002) and also a pioneer of open innovation (West, 2007; Gassmann and Enkel, 2006). Open innovation is a model where firms commercialise both external and internal resources to generate value. This concept challenges the dominant view of closed innovation where it is assumed that it is the experts 'within' the company that invent and design innovative new products to meet customer needs (Chesbrough, 2006). However, shorter innovation cycles, the rising costs of industrial research and development, and a lack of resources have motivated a change in organizational innovation strategies towards a more open approach. OSS is viewed as the most prominent example of the revolutionizing of traditional innovation processes (Gassmann and Enkel, 2006). Indeed, it demonstrates two key elements of the open innovation concept – namely the collaborative development of the technology and shared rights to the use of that technology. In its emergent form, OSS represented a community-based software development model where geographically dispersed programmers collaborated to produce software (West and O'Mahony, 2005). However, OSS has since transitioned into the realm of mainstream business and plays an important role in the business models for firms in high technology and other industries (Rajala and Westerlund, 2008; Fitzgerald, 2006). While some research has addressed how OSS business models generate revenue and reduce costs (e.g. Rajala et al., 2006; Krishnamurthy, 2005; Koenig, 2004; Weber, 2004; and Hecker, 2000), the majority of these studies theorise about the possibilities of revenue generation without rigorous empirical data. In addition, revenue generation has been the prime focus of this research, resulting in the value component being neglected. The current literature on value creation and capture with OSS within the open innovation paradigm is also limited, with only one study by West (2007) to date. Indeed, that study was oriented towards IT vendors based in the U.S. despite Chesbrough and Crowther's (2006) assertion that open innovation practices are not limited to 'high-tech' sectors. It has been suggested that the very concept of OSS requires all types of firms to rethink their strategy. In addition, the shift of focus from ownership to one of openness requires a reconsideration of the processes that facilitate value creation and value capture Chesbrough and Appleyard (2007). The emergence of OSS poses a puzzle for conceptions of organisational theory. Our traditional understanding of the organisation has been that individuals organize their productive activities in two ways, either as employees in firms, following directions of managers or as individuals in markets responding to market signals (Coase, 1937). OSS, however, does not rely on markets or traditional managerial hierarchies to organise production (Benkler, 2002). Like open innovation, OSS involves collaboration between firms, suppliers, customers and makers of related products to pool software R&D (West and Gallagher, 2006). The objective of paper is to explore how firms utilising OSS create and capture value. This paper describes the results of a theory building process based on analysis of extant research; delineating constructs and the relationship between these constructs in the form of theoretical propositions.

2 BUILDING THE THEORETICAL FRAMEWORK

Over the years, the most frequently voiced question for firms is how to sustain competitive advantage. More recently, however, this question has transformed into how firms create and capture value. However, little research has directly focused on these fundamental questions in general. Indeed, research has only paid lip service to the notion of value creation, with the vast amount of it focussing on value appropriation for sustainable competitive advantage (Nickerson et al, 2007). While value creation and capture have been identified as two important dimensions of a business model, much of the managerial and academic interest in business models concentrate on how to appropriate value from new Internet-enabled businesses (West, 2007). The process of value creation is also often confused with the process of value capture and it has been argued that both value creation and value capture should be viewed as distinct processes, since the source that creates value may or may not be able to capture or retain the value in the long term. For example, value created by an organisation, perhaps

through the introduction of a new product or process, may not be entirely captured by them but instead may spill over into society as a whole (Lepak et al., 2007). Thus, in order to better understand value creation and value capture with OSS, it is important to examine both concepts. While the current literature on value creation and value capture processes with OSS is sparse, both processes have been touched on using several theoretical perspectives. In this study, we use a process of theory building proposed by Dubin (1969) and Whetten (1989) that consists of analysing extant research and delineating constructs and the relationships between them in the form of theoretical propositions. Specifically, we analyse extant literature on (1) value creation and value capture with OSS and (2) existing theoretical frameworks that review value creation and value capture in general.

2.1 Value Creation

Value creation is a universal dimension found in recent conceptions of business models, and necessitates identifying a relevant customer segment, the value proposition for those customers, and the ways in which the business model will provide that value (Chesbrough and Rosenbloom, 2002; Morris, 2005; West, 2007). In West's (2007) study of OSS business models in IT vendor firms, business buyers were identified as the relevant customer segment, and lower costs and avoidance of vendor lock-in were identified as the key value propositions. In addition, this study found that as business buyers expect a richer "whole product" solution including integration, customization, support and other services, OSS vendors had the opportunity to combine priced and un-priced complementary assets to create value. Complementary assets, also called complementarities (Amit and Zott 2001), are those assets (such as resources, capabilities, know-how, goods or services) that surround the successful commercialization of an innovation (Teece, 1986; Dodgson et al., 2008). However, such complementary assets are often to be found in a value network (Shafer et al., 2005; West, 2007).

2.2 Traditional Approaches to Value Creation

2.2.1 Transaction Cost Economics

The concept of transaction cost economics (TCE), first introduced by Coase in the late 1930s as a first attempt to explain why firms exist (cf. Coase 1937) and later extended and developed by Williamson (1981), is essentially a single company oriented analysis of cost minimization where transaction efficiency is identified as a major source of value, i.e., enhanced efficiency reduces costs. Furthermore, organizations that economise on transaction costs can be expected to extract more value from transactions (Amit and Zott, 2001). However, one of the limitations of this theory is its stringent focus on transactions and the view of the boundaries between market and hierarchy (Rajala and Westerlund, 2005). As already mentioned, OSS projects do not rely either on markets or on managerial hierarchies to organise production. While research on open source through a TCE lens is in its infancy (Niederman et al, 2006) it has also been found that the emphasis of transaction cost economics on efficiency may divert attention from other important sources of value such as innovation and the reconfiguration of resources (Ghoshal and Moran, 1996). In addition, TCE's focus on cost minimisation and neglects innovation (Lazonick, 1993) and the mutual relationship between exchange parties and the opportunities for value creation that this presents (Amit and Zott, 2001). It has also been found that partners in open innovation are not interested in transaction cost minimisation (Vanhaverbeke et al., 2007); in the pursuit of transactional value they will choose cooperative and collaborative modes with higher transaction costs, as long as eventual joint gains prevail over transaction costs (Zajac and Olson, 1993).

2.2.2 Value Chain Analysis

Porter's (1985) value chain framework analyses value creation at the firm level and addresses the activities a firm should perform. It also examines the configuration of the firm's primary and support activities that would enable it to add value to the product and to compete in its industry. The goal of these activities is to create value that exceeds the cost of providing the product/service. Porter suggests that in order for a company to deliver customer value and satisfaction, they must manage the value

chain. Value can be created through differentiation along every step of the chain resulting in products and services that lower buyers' costs or raise buyers' performance. However, this type of framework was found to be more suitable to describing and understanding value creation in a traditional production and manufacturing company and less so in service industries where the resulting chain does not fully capture the real meaning of value creation (Stabell and Fjeldstad, 1998). In addition, this framework focuses on value creation as a linked chain of activities; a perspective that leads to the development of strategies that concentrate on controlling this chain (Peppard & Rylander, 2006). Porter (1985) further argues that a firm's value chain links to the value chain of both suppliers and of buyers of products and services, resulting in a large stream of activities called the value system. However, there is a major distinction between value creation in the open innovation and open source context and within the classical value system. For example, while every company in the classical value system occupies a particular position within the system and adds value to inputs before passing them on to the next actor in the chain, relationships between these actors (e.g. suppliers, substitutes, etc.) can be described as simple exchange relations, mainly dealt with by means of arms-length transactions. As Vanhaverbeke et al. (2007, p.5) point out, "managing and organising requirements are restricted to activities within the firms. There is a clear distinction between firms and markets; outside the firm boundaries only markets exist". Additionally, in open innovation, firms jointly create value through a number of non arm-length transactions in value networks (Vanhaverbeke et al. 2007).

2.2.3 Knowledge-Based View of the Firm

In contrast to the Porterian model and TCE-based theory, the knowledge-based view treats knowledge as a key resource underlying value creation (Grant, 1997). Originating from the strategic management literature, the knowledge-based view of the firm (KBV) has largely extended that of the resource-based view (RBV) of the firm (see section 2.4.4). While RBV tends to focus on value appropriation (Kapler, 2007), the KBV treats knowledge assets as a strategic competitive advantage and strategy of the firm. Kang et al. (2007) suggests that a firm's success rests on its ability to offer new and superior customer value, which in turn relies on its ability to explore and exploit employee knowledge that can become the basis for significant innovations that create value for targeted customers. In addition, a knowledge-based perspective suggests that organizations that have superior knowledge resources are able to coordinate and combine their traditional resources and capabilities in new and distinctive ways (Teece et al., 1997). However, the existing literature on KBV has some significant shortcomings. For example, this approach has been criticised for its lack of empirical literature. Indeed Eisenhardt and Santos (2002) point out that while KBV as a theory of strategy rests on the assumption hat knowledge is the most important resource, there appears to be very little empirical evidence to substantiate this. In addition, many of the perspectives on KBV are quite static in that they see the control and protection of knowledge as the basis for sustainable competitive advantage because it is the most difficult to imitate (Eishenhardt & Santos, 2002; McEvily & Chakravarthy, 2002; Liebeskind, 1996). In other words, the dominant view is how best a firm can accumulate, apply, integrate and protect knowledge inside a firm. From an open source and open innovation perspective, a firm's knowledge should extend beyond its boundaries and enable knowledge flows with other firms. When a firm increases its internal knowledge base by bringing in external knowledge, it can use this new knowledge to generate new innovations (Vanhaverbeke et al., 2007).

2.2.4 Dynamic Capabilities

Dynamic capabilities is another body of literature in the field of strategic management concerned with examining how organizations create value by developing new capabilities and competencies in a dynamic environment (Teece et al., 1997). Dynamic capabilities are those organizational and strategic routines that lead managers to alter their resource base, i.e. obtain and shed resources, integrate them together and recombine them, to generate new value-creating strategies (Eisenhardt and Martin, 2000; Grant, 1997; Pisano, 1994). However, some researchers remain sceptical about the nature and role of dynamic capabilities. It has been argued that few empirical studies have engaged in defining, operationalising and measuring the impact of dynamic capabilities on firm performance. (Protogerou et al., 2005). Thus, the "emergent literature on dynamic capabilities and their role in value creation is

riddled with inconsistencies, overlapping definitions, and outright contradictions" (Zahra et al., 2006, p. 918).

2.2.5 *Schumpeterian Innovation*

In Schumpeter's (1934) theory, innovation is the source of value creation. Schumpeterian innovation emphasizes the importance of technology and considers novel combinations of resources and the services they provide as the foundation of new production methods, which in turn lead to the transformation of markets and industries (Amit and Zott, 2001). However, open innovation and OSS broaden this idea of innovation since these models spans firm and industry boundaries, involving new methods of exchange and collaborative development, rather than simply new production processes.

2.3 The Importance of a Value Network for Value Creation

The above frameworks have some shortcomings in examining value creation with OSS. For example, models like transaction cost economics and the value chain framework do not account for the nature of alliances, competitors, complementors and other members in *value networks* (Peppard and Rylander, 2006). OSS and open innovation differ from the TCE approach in that TCE focuses on minimising costs in order to create value, rather than maximising value through cooperative modes in networks. In addition, the knowledge-based view of the firm focuses on knowledge that is controlled within the firm while OSS and open innovation is concerned with combining and exchanging knowledge in value networks. Value networks are key conduits through which knowledge flows from the environment to the firm and vice versa (Simard and West, 2008). Indeed, they are viewed as vehicles for producing, synthensising and distributing ideas and increasingly the success of a firm is linked to the depth of their ties to network partners. Value networks constitute four dimensions – value creation, transactions, the combination of resources and capabilities of different partners and finally networking. However, they have to be considered jointly to understand the process of value creation and cannot be sufficiently addressed by theoretical frameworks that only address one of these dimensions (Vanhaverbeke and Cloodt, 2008), such as those listed in Section 2.2 above which neglect the importance of combining the resources/capabilities of various partners outside the firm and networking. Value networks are entities consisting of several connected individuals or organisational actors that transform and transfer various resources in order to create value not only for the network's end customer but also for themselves (Helander and Rissanen, 2006). A network offers the firm the potential to share risk, generate economies of scale (Katz and Shapiro, 1985; Shapiro and Varian, 1999), share knowledge and facilitate learning (Dyer and Nobeoka, 2000; Dyer and Singh, 1998). In other words, networks provide firms with opportune access to knowledge and resources that are otherwise unavailable, while also testing internal expertise and learning capabilities (Powell, 1998). When these networks work, they allow firms to create value that no single firm could have created alone (Adner, 2006).

In a value network environment, organizations focus not on the firm or industry, but on the value-creating system itself, which includes suppliers, partners, allies and customers and other network players working together. The firm focuses on creating value, where value is determined by the resources and capabilities assembled and combined by different partners and how well they perform joint tasks (Vanhaverbeke and Cloodt, 2008; Hamel, 1991). West (2007) also highlights the importance of competitors in a firm's value network, as these competitors often collaborate to further develop or stimulate adoption of a shared technology. For example, Nokia and Sony Ericsson are two such competitors that collaborate in a value network, i.e. the open source Eclipse foundation, to simplify mobile development. In the context of OSS, Dahlander (2004) proposes that in addition to inter-organisational relations, relationships between the firm and the OSS community (users and developers) are equally important. It has been argued that innovation is positively influenced by a firm's access to complementary skills and a broad knowledge-base that facilitates different types of knowledge exchange in a network context (Simard and West, 2006). In addition, substantial knowledge exchange in a network leads to value creation as it facilitates joint learning, fosters

problem-solving, and the integration of complementary resources enables joint creation of products, technologies and services (Parise and Henderson, 2001). It has been found that the degree of value creation from an OSS value network depends on (a) the number of adopters that attract suppliers of complementary goods and services and (b) the number of third parties that are qualified to contribute core or complementary technologies and are willing to do so. These may be complements that are integrated and sold as a whole product or complements that are sold or given away separately, thus increasing the value of the core innovation, as with the numerous projects created at SugarForge.org, an open source website hosted by SugarCRM, an OSS vendor (West, 2007). Learning how to create value when companies are highly reliant on each other in a value network, however, is an underexplored area in the literature. For the majority of companies, decisions are usually made within the boundaries of the firm and the external environment viewed as an arena where firms compete with one another (Vanhaverbeke, 2008). This is apparent in most firms utilising OSS. The software is basically treated the same as any other third-party software and typically only one-way interaction between the firm and the environment takes place, resulting in clear distinct boundaries between the two (Alexy and Henkel, 2009). In a value network, value is co-created or co-produced. Thus, companies with complementary capabilities have to be fully committed to cooperate in the value network. As Vanhaversbeke (2008, p. 218) suggest, "creating value cannot be done unilaterally based on the efforts of a single, focal firm, nor can it be done without keeping in mind the different and divergent interests of all collaborating partners". Therefore, the value a firm creates from being part of a network depends on how well partners' objectives are aligned to each other and on partners' commitment to invest in complementary assets (Teece, 1986; Moore, 1991). Successfully ensuring alignment of objectives and partners' commitment, however, relies on two important issues. First, the firm has to structure and manage the value network so that the potential of the network to create joint value is maximised. Secondly, it has to make agreements with network participants to share this jointly created value (Vanhaverbeke and Cloodt, 2008). Thus, resources and capabilities of network actors have to be effectively combined and governed at the network level. Trust, leadership and a unifying vision play an important role in bringing disparate partners together in a network and the absence of internal competition among participants in the network is crucial (Gomes-Casseres, 2003). Thus, the firm will have to actively nurture the value network to manage potential tensions or conflict between participants. Additionally, the firm has to make a number of arrangements with other participants to stick to the network, e.g. offer incentives such as access to information and knowledge, compensation etc. (Vanhaverbeke and Cloodt, 2008). Based on the analysis above, the following propositions are delineated:

***Proposition 1*:** Being part of a value network of potential complementors is critical to the ability of a firm to create value with OSS.
***Proposition 2*:** The greater the level of commitment, volume of knowledge exchange and alignment of objectives in a value network, the greater the potential for firms to create value with OSS.
Proposition 3: A firm's ability to effectively combine and govern resources and capabilities in the value network will facilitate greater value creation with OSS.

2.4 Value Capture

Value capture or value appropriation explains how a firm captures value from its value creation in order to sustain the business model (West, 2007). Some of the key steps in formulating a value capture strategy are defining a revenue model; ensuring the cost structure is consistent with the customer's perception of value (Amit and Zott, 2001), and establishing durable external relationships between the firm and customers and third parties (Chesbrough and Rosenbloom, 2002). Open source software has limited appropriability, and thus reduced potential for value capture, compared to proprietary software because the source code is available for reuse and modification by competitors, customers and complementors. Therefore, the revenue model focuses on the sale of complementary goods and services to complete the whole product solution. In terms of establishing durable external relationships, firms make source code open in the hope of attracting external contributions from third

parties and competitors. Other value capture strategies include non-monetary gains such as access to tacit knowledge and an excellent reputation useful in marketing. As with value creation, complementary assets play an important role in capturing value from an innovation and so the innovator must entice third-party suppliers of these complementarities to complete the innovation. Yet again, a firm's position in a value network of potential complementors determines the value captured (West, 2007).

2.5 Traditional Approaches to Value Capture

2.5.1 Neoclassical Theory

Traditional neoclassical theory focuses on value captured in the form of monopoly rents (Lazonick, 1993, Moran and Ghoshal, 1996; Pitelis, 2002). A typical neoclassical firm controls the transformation of inputs (resources it owns) into outputs (sale of products) and earns the difference between what it receives in revenue and what it spends on inputs. In this theory, firms compete based on price but as Baumol (2002) argues, innovation rather than price is the primary competitive dimension and less innovative firms will find their markets shrinking as they lose business to more innovative competitors. It has also been argued that this theory views the firm as essentially a perfectly efficient 'black box' concerned with maximising profits and has nothing to say about the internal organisation of the firm or innovation for that matter (Hart, 1995; Teece, 1986). Thus, OSS innovation is not easily explained in neoclassical economic terms. The production of goods in a neoclassical firm includes a formal division of labour that uses proprietary knowledge, is guarded by restrictive IPR and managed 'within' a hierarchy that guides and governs the process. In contrast, OSS production and distribution is practically based on the absence of a hierarchy and is fundamentally about cooperation and collaboration. For example, collaborative OSS projects such as Linux and Apache have demonstrated empirically how the production process takes place in a voluntary community-based setting with developers working in a highly parallel, relatively unstructured way and without direct monetary compensation (Weber, 2004).

2.5.2 Industrial Organisational Theory

Industrial organisational theory of the 1950s and 1960s is useful in determining the likely profitability of an industry and in turn the value appropriated by firms (Porter, 1981). The firm in traditional industrial economics focuses on market structure. In this approach, exogenous demand and supply conditions determine industry structure, which in turn determines the conduct of firms, and performance depends upon various properties of the industry including the degree of concentration, barriers to entry, product differentiation and the presence of scale economies (Porter, 1981; Seth and Thomas, 1994). However, it has been argued that this view is characterised by the same black box metaphor as the neoclassical approach, treating the firm as a product of deterministic forces and ignoring inter-firm differences (Seth and Thomas, 1994). In addition, this view has been criticised for it preoccupation with value captured in the form of monopoly rents as the basis for explaining and predicting firm performance (Moran and Ghoshal, 1996; Pitelis, 2002). Yet again, open innovation and OSS suggest activities that are the opposite extreme of this theory. Open source software is not about erecting barriers to entry and excluding potential rivals. Rather, OSS promotes anti-rivalry and inclusiveness. These two dimensions result in positive network externalities where cooperation between contributors becomes the rule, not the exception (Cooper, 2005).

2.5.3 Value Chain Analysis

The concept of value chain analysis has focused on ways in which firms may configure their primary and support activities to maximize and sustain competitive advantage (Porter, 1985). According to Porter, 'value is measured by total revenue…a firm is profitable if the value it commands exceeds the costs involved in creating the product' (1985:38). However, as with value creation, the value chain model appears to be more suited to describing and analyzing a traditional manufacturing firm and less suited to the analysis of activities in service industries (Stabell and Fjeldstad, 1998). In addition, the value chain analysis is an incomplete instrument for analyzing value capture with OSS since it does

not span firm boundaries and value capture is measured solely in monetary terms. Contributors to OSS also value non-monetary gains such as recogition, access to code and technical knowledge.

2.5.4 Resource-Based View of the Firm

The resource-based view (RBV) of the firm is also concerned with questions of value appropriation and sustainability of competitive advantage (e.g. Barney, 1997). This view conceptualizes the enterprise as a bundle of resources and capabilities. In order to create and sustain competitive advantage and capture above-normal rates of returns, these resources must be scarce, valuable and reasonably durable (Barney, 1997). According to Barney (1997, p. 147), a firms' resources and capabilities are "valuable if, and only if, they reduce a firm's costs or increase its revenues compared to what would have been the case if the firm did not possess those resources". In addition, the RBV places greater emphasis on the prevention of other firms from appropriating the firm's own existing rent streams (Moran and Ghoshal, 1996). Furthermore, proponents of the resource-based view emphasize that a sustainable competitive advantage is based on those resources and capabilities that are owned and controlled 'within' the boundaries of a single firm (Dyer and Singh, 1998). From and OSS and open innovation perspective, however, resources should not be closed off within one single firm. Rather, durable, valuable and scarce resources of different firms should be combined in order to capture value (Vanhaverbeke, et al., 2007).

2.6 The Importance of a Value Network for Value Capture

It is evident that the above theoretical frameworks for value capture are based upon ownership and control as the key levers in achieving strategic success and aim to protect, rather than share, valuable resources and capabilities that are housed within the firm. All focus largely within the firm and take no notice of the potential value of external resources (such as those of a value network) that are not owned by the firm in question (Chesbrough and Appleyard, 2007). From the OSS and open innovation perspective, resources should not be closed off within one single firm. Rather, durable, valuable and scarce resources of different firms should be combined in order to capture value (Vanhaverbeke, et al., 2007). While Porter's value-chain analysis may be somewhat valuable in examining open innovation and value networks, value is determined by the performance of individual partners, not by the cohesion and structure of the network as a whole (Vanhaverbeke and Cloodt, 2008). Additionally, while the RBV stresses issues like independence and the role of competition between firms based on the unique resources and capabilities it possesses, in contrast OSS and open innovation emphasise the interdependence of complementary resources of firms in a value network in order to introduce a new innovation to the market (Vanhaverbeke et al., 2007). As with value creation, the value network created around a business shapes the role that suppliers, customers and third parties play in influencing the value captured from commercialization of an innovation (Chesbrough and Rosenbloom, 2002). In an OSS value network, firm often gain a large pool of users and third-party complementors to increase the value of their product/service. Users often reveal their internal complements for use by others because they may not be able to capture value from minor improvements, or because they gain other benefits from the disclosure, e.g. recognition. On such example is the contribution of foreign language translations as is the case of Zend with PHP and Sun Microsystems with OpenOffice (West, 2007).

In a value network, value capture has to be considered jointly with the value creation strategy because in both cases the commitment of the participants, the alignment of their objectives, and the exchange of knowledge among them, determine the amount of value captured (Vanhaverbeke and Cloodt, 2008). As Peppard and Rylander (2006) argue, the flow of knowledge and other resources in the network is vital for its sustainability. Firms can capture value by developing superior knowledge-sharing routines with partners in the network. This, however, is dependent on incentives that encourage partners to be transparent, to transfer knowledge and prevent free riding on the knowledge acquired from the partner (Dyer and Singh, 1998). In addition, each participant should capture some value from its contribution to the network. Two factors determine the strength of the value network: the extra value created in

comparison with competing value systems, and the commitment of the different participants in the network. It has been further suggested that each participant reap some benefits to ensure that one stays committed. Fair distribution of value in a network is also important because while some participants are automatically better off in the network, others might be worse off and have to receive some return in order to stay committed to the value network. Thus, the value captured in a network depends on how well participant resources are combined and managed within the network. In order to optimise value capture, a firm will have to orchestrate the network partners, lead and nurture them while minimising any potential tensions and instilling a unifying vision (Vanhaverbeke and Cloodt, 2008). Thus, three more propositions are presented:

Proposition 4: Being part of a value network of potential complementors is critical to the ability of a firm to capture value with OSS.
Proposition 5: The greater the level of commitment, volume of knowledge exchange and alignment of objectives, the greater the potential for firms to capture value with OSS.
Proposition 6: A firm's ability to effectively combine and govern resources and capabilities in the value network will facilitate greater value capture with OSS.

We now conclude our process of building a preliminary model from extant research by presenting the constructs and the relationship between them in Figure 1.

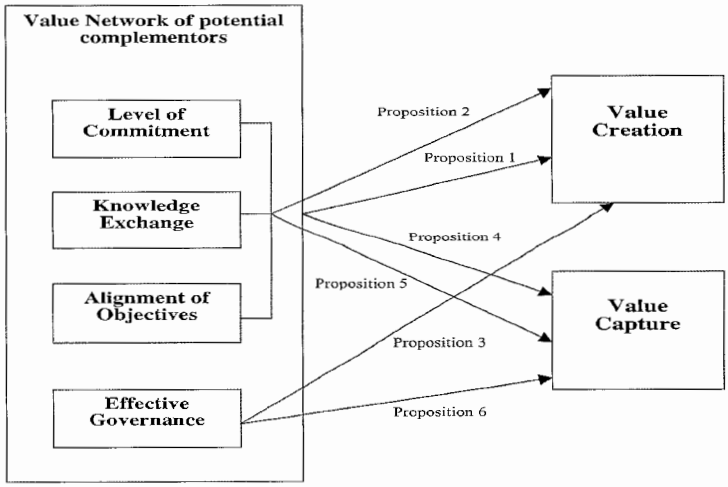

Figure 1. Theoretical Model of Constructs and Relationships

3 DISCUSSION

It is apparent from the analysis in section 2 that the traditional methods for analysing value creation and capture are not suitable for open innovation environments such as OSS. For example, they take no notice of a value network despite the apparent importance of network-based activities between customers, suppliers and third-parties for successful value creation and capture with OSS. Therefore, we have identified the need for a value network in order for firms to accomplish both processes, and have specified our conceptual model as six propositions (see Figure 1). As each framework only offers a partial explanation of value creation and capture, we feel a more integrative theoretical framework is needed. Thus, we argue that a business model lens offers a more effective approach to better explore and understand value creation and capture with OSS. The most obvious opportunity in utilising this framework is the fact that few, if any, scholars have taken seriously the business model lens for studying value creation and capture with OSS, instead focussing on how to capture value from new Internet-enabled businesses. The business model uses both external and internal ideals to create value, while defining internal mechanisms to claim some portion of that value (Chesbrough, 2006). Several researchers have explored what might be included in a business model and have decomposed business

models into components. These components have also been referred to as ''functions', ''elements', 'attributes', or 'pillars' of business models. Osterwalder et al., (2005) investigated what elements were used in business model research and propose a meticulous ontology that focuses on nine building blocks that make up a business model (see Table 1).

Table 1. Nine Business Model Building Blocks (Source: Osterwalder et al., 2005)

Pillar	Building Block	Description
Product	Value Proposition	Gives an overall view of a company's bundle of services and products
Customer Interface	Target Customer	Describes the segment of customers the company wants to offer value to
	Distribution Channel	Describes the various means of the company to get in touch with its customers
	Relationship	Explains the kind of links a company establishes between itself and its different customer segments
Infrastructure Management	Value Configuration	Describes the arrangement of activities and resources
	Core Competency	Outlines the competencies necessary to execute the company's infrastructure business model
	Partner Network	Portrays the network of cooperative agreements with other companies necessary to efficiently offer and commercialise value
Financial Aspects	Cost Structure	Sums up the monetary consequences of the means employed in the business model
	Revenue Model	Describes the way a company makes money through a variety of revenue flows

This ontology also builds on and integrates ideas advocated by several of the traditional theoretical frameworks outlined in this paper. Firstly, it draws on Porter's value chain analysis, by concentrating on the importance of configuring activities and processes for value creation and capture. It also builds on the theory of transaction cost economics as it looks at the relationship between participants in the business venture, focusing on aspects such as the transactional elements involved in the interaction between firm and client. This ontology is also consistent with Schumpeter's innovation theory in that it is concerned with sources of innovation such as new product offerings, distribution channels and creation of new markets. In addition, it also considers the core competencies, i.e. unique resources and capabilities, that firms need to possess in order to create and capture value, and thus is consistent with the dynamic capabilities and resource-based view of the firm. This business model concept is also concerned with storing, mapping and externalising knowledge about the value creation logic of a firm (Osterwalder et al., 2005) and has a lot in common with the knowledge-based view of the firm. However, one important building block that is embedded in this ontology is that of a partner network, an element that is lacking in the existing theoretical approaches and something that is deemed extremely important for this study. In addition, this business model ontology considers jointly all four dimensions of a value network as recommended by Vanhaverbeke and Cloodt (2008), namely value creation, transactions, the combination of resources and capabilities and finally networking. Thus, future research should consider utilising this ontology (Table 1) as a lens to examine value creation and value capture with OSS.

4 CONCLUSION

This paper explored some of the existing theoretical frameworks used to review value creation and capture. Consequently, a theoretical model was developed to frame research on value creation and capture with OSS. On the one hand, each theoretical approach presented in this research is useful in examining a particular aspect of value creation and capture, e.g. minimizing transaction costs (TCE), combining unique resources and capabilities (RBV) and configuring firm activities to create and capture value (Porter's value chain analysis). On the other hand, however, value creation and capture with OSS cannot be sufficiently addressed by such theoretical frameworks that only emphasise one particular dimension of the process. After all, the dominant argument that has emerged from this

research is the need for a value network in order to successfully create and capture value with OSS. Gaining access to a value network of potential complementors is crucial for value creation/capture. However, successful value creation and capture depends on the level of commitment, volume of knowledge and how well a firm's objectives are aligned to other partners in the network. In addition, firms can generate and capture more value through the effective combination and governance of resources and capabilities of all actors in the network. Thus, a more integrative framework is needed, one that jointly considers all dimensions including networking. In this regard, the business model ontology proposed by Osterwalder and Pigneur could well serve as a nexus for examining how firms create and capture value with OSS, given that it builds on and integrates different theoretical perspectives and also considers the role of a partner network.

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